

Algebra 8-8: Powers of Products & Quotients

Warm-Up

Multiply.

1. $(\frac{2}{3})(\frac{2}{3})$

$$\frac{2}{3} \cdot \frac{2}{3} = \boxed{\frac{4}{9}}$$

2. $(\frac{4}{5})(\frac{4}{5})$

$$\frac{4}{5} \cdot \frac{4}{5} = \boxed{\frac{16}{25}}$$

3. $(3x)(3x)$

$$3 \cdot 3 \cdot x' \cdot x' = \boxed{9x^2}$$

4. $(-4x)(-4x)$

$$-4 \cdot -4 \cdot x' \cdot x' = \boxed{16x^2}$$

Property

Definition

Example

Power of a Product

$$(ab)^n = a^n b^n$$

$$(2x)^4 = 2^4 x^4 = \boxed{16x^4}$$

Power of a Quotient

$$\left(\frac{a}{b}\right)^n = \frac{a^n}{b^n}$$

$$\left(\frac{2}{x}\right)^4 = \frac{2^4}{x^4} = \boxed{\frac{16}{x^4}}$$

$$\frac{2}{x'} \cdot \frac{2}{x'} \cdot \frac{2}{x'} \cdot \frac{2}{x'} = \boxed{\frac{16}{x^4}}$$

Remember...

- When in doubt, write it out!

$$\begin{aligned} (-\#)^{\text{even}} &= \text{positive} \\ (-\#)^{\text{odd}} &= \text{negative} \end{aligned}$$

Examples

Simplify.

1. $2(5x)^3$ $250x^3$

$$\begin{aligned} 2 \cdot 5^3 \cdot x^3 \\ 2 \cdot 125 x^3 \end{aligned}$$

2. $(-xy)^5$ $-1x^5y^5$

$$\begin{aligned} (-1xy)^5 \\ (-1)^5 x^5 y^5 \end{aligned}$$

3. $-(-a^2b^3)^4$ $-1a^8b^{12}$

$$\begin{aligned} -1(-a^2b^3)^4 &= -1 \cdot (-1)^4 (a^2)^4 (b^3)^4 \\ &= -1 \cdot 1 a^8 b^{12} \end{aligned}$$

4. $(2/3)^5$ $32/243$

$$\begin{aligned} \left(\frac{2}{3}\right)^5 &= \frac{2^5}{3^5} \\ &= \frac{32}{243} \end{aligned}$$

5. $(2x/y)^4$ $\frac{16x^4}{y^4}$

$$\left(\frac{2x}{y}\right)^4 = \frac{2^4 x^4}{y^4}$$

6. $(2x/5y)(7/xy)^3$

$$\begin{aligned} \left(\frac{2x}{5y}\right) \left(\frac{7}{xy}\right)^3 \\ \frac{2x}{5y} \cdot \frac{7^3}{x^3 y^3} \end{aligned}$$

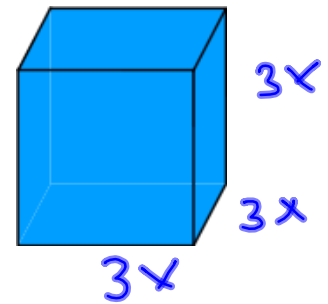
$$\begin{aligned} \frac{2x}{5y} \cdot \frac{343}{x^3 y^3} &= \frac{686x}{5y^4 y^3 x^2} \\ &= \frac{686}{5y^4 x^2} \end{aligned}$$

7. Find the volume of a cube with a side-length of $3x$.

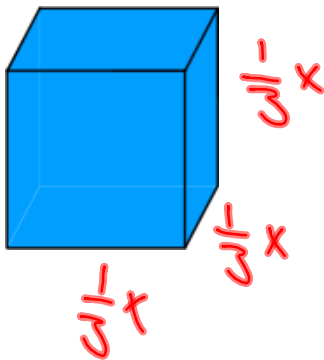
$$V = l \cdot w \cdot h$$

$$V = \underline{3x} \cdot \underline{3x} \cdot \underline{3x}$$

$$V = 27x^3 \text{ units}^3$$



8. Find the volume of a cube with a side-length of $(1/3)x$.



$$V = l \cdot w \cdot h$$

$$V = \frac{1}{3}x \cdot \frac{1}{3}x \cdot \frac{1}{3}x =$$

$$= \left(\frac{1}{3}x\right)^3 = \boxed{\frac{1 \cdot x^3}{27} \text{ units}^3}$$